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Notes on the North American Species of Eriocauleæ.

By THOMAS MORONG.

This order is sparsely represented in North America, consisting in fact only of a few outlying members of a tropical family. A single species only is found as far north as Canada, the greater number occurring in the warm sections of the United States. The genus *Lachnocaulon*, however, is endemic in our country, and therefore has a special interest for us. The great bulk of the family is confined to South America, where three-quarters of the three hundred and twenty-five species embraced in it occur. Our own species have been imperfectly investigated and poorly defined, and for this reason the present paper has been prepared in the hope that something may be contributed towards a better understanding of their characters and geographical distribution.

In general aspect these plants may be easily recognized, being very peculiar. The flowers are androgynous or diæcious and contained in more or less hemispherical heads which are enclosed by involucral scales as in the Compositæ. In the place of growth they favor swampy grounds or shallow water, but a few grow in low sandy barrens or fields. In mode of growth they are cæspitose, and new tufts of leaves are added year by year to the stock so that in time quite a little colony is collected about the same caudex, from which scapes, sometimes very numerous, are annually sent up. The scapes are nearly always twisted in the growth, and always marked longitudinally by angles, which are frequently interrupted by intermediate ridges or striæ. As these intermediate ridges are often partial, the number of angles assigned to a scape will vary with the point

at which the number is reckoned. This will account for the discrepancy which occurs in the statements of different observers. The large roots are spongy or often conspicuously nodose for their whole length. With three of the genera we have no concern, as two of them, *Philodice* and *Tonina*, both together numbering five species, are restricted to tropical South America, and the other, *Mesanthemum*, numbering three species, is endemic in tropical Africa.

The North American genera may be briefly distinguished as follows:

Segments of the perianth four or six.

Stamens separate. Anthers two-celled. Stamens as many as the perianth segments.

1. Eriocaulon.

Stamens one-half as many as the perianth segments.

2. Dupatya.

Perianth of three segments. Stamens three, monadelphous below.

Anthers one-celled.

3. Lachnocaulon.

Eriocaulon is the most extensively diffused genus, being found in tropical and subtropical regions throughout the world. classified by Körnicke in his monograph the species are divided into fourteen sections. All the species occurring within the borders of the United States, so far as known, are acaulescent or nearly so, the heads single on erect peduncles or scapes, the perianth with one exception four-parted and the stamens four; the Mexican species are the same except in having six-parted flowers and six stamens. The perianth segments, at least the upper ones, are usually spotted with a minute black gland near the centre or the apex. The heads are generally quite villose and grayish in appearance, the parts of the perianth being strongly bearded. The flowers are each subtended by a bract quite similar in markings and general appearance to the perianth segments. brown when mature and, under the lens, covered with blunt or spiny protuberances.

As the perianth segments are in two series and often separated at a considerable distance, there is much variation in the language applied to them by botanists. Körnicke calls the floral envelopes a double perigonium, the exterior calyculate and interior subcorolline. Kunth speaks of them as a double calyx, while others

still regard them as calyx and corolla. The segments of the two series are alternate with each other, sometimes one or both pedicellate or tubular below, sometimes free and separate, often partially or wholly connate.

The floral appendages of these plants constitute a morphological feature of great interest. In Eriocaulon the appendage of the staminate flower appears like a style included in and coalescent with the tube of the inner segments, projecting between the bases of the stamens in three small black points which look much I do not find this in the pistillate like the segmental glands. In Dupatya and Lachnocaulon the appendages are more marked. In the staminate flower they stand up in two or three distinct lobes which are often papillose. In the pistillate flower they are attached to the style in or below the sinuses of the stigmas, apparently enclosing and cohering with the style. Nearly all the botanists who have noticed these appendages regard those of the staminate flowers as rudimentary pistils. Kunth considers them so in both kinds of flowers, but most botanists are content to call those of the fertile flowers merely appendages.

Of the following species seven occur in the United States and five in Mexico, of which two are more particularly described as they approach our boundary near enough to render it probable that sooner or later they will be detected on this side of the border.

I. ERIOCAULON ARTICULATUM (Huds.).

Nasmythia articulata, Huds. Fl. Ang. Ed. 2, i, 415 (1778). E. pellucidum, Mx. Fl. ii, 166 (1803).

E. septangulare, With. Ar. Br. Pl. ii. 257. (1818); Torr-Bot. N. Y. ii. 335 (1843), and other American authors.

Stem a mere crown. Leaves pellucid, three to eight nerved, fenestrate, acuminate, ½ to 3 inches long, usually equal to the sheaths. Scapes weak, commonly twisted, about seven-angled, smooth, mostly from 4 to 8 inches in height, but sometimes scarely one inch, and when submersed often elongating till they are from 4 to 10 feet long, usually solitary but occasionally clustered. Involucral scales smooth or the innermost bearded at the apex, oblong, obtuse, entire, scarious, of a livid or fuscous tint, usually shorter than the flowers. Heads androgynous, the

marginal flowers usually staminate. Bracts cuneate or obovate, abruptly pointed, fuscous above and white bearded, receptacle smooth, flowers about I ¼ lines high, the outer sterile perianth tubular below and its lobes at some distance from the inner, all bearded at the apex. The gland is borne sometimes on the bract and both pairs of segments, and sometimes only on the upper pair. One of the upper pair is generally larger than the other. Fertile flowers scarcely more than half the size of the sterile, the pairs of perianth segments without a tube, and much nearer together than the sterile, all densely bearded.

Still, shallow water, ponds and streams, Newfoundland to Ontario, New England and Minnesota, south to Florida and Texas-Occurs in Great Britain. July to October.

2. ERIOCAULON COMPRESSUM, Lam.

E. compressum, Lam. Encyc. iii. 276 (1789); Körnicke, Linnæa, xxvii. 592 (1854).

E. gnaphalodes, Mx. Fl. ii. 165 (1803), and American authors generally.

Leaves coarsely or finely six to twenty fenestrate-nerved, usually shorter than the sheaths, tapering to a long, sharp point, rigid, or when submerged thin and pellucid, scapes 6 to 35 inches high, smooth, more or less compressed when dry, ten to twelve angled. Involucral scales rounded, obtuse, scarious, shining, smooth, imbricated in three or four rows, heads frequently dioecious, 3 to 6 lines in diameter. Receptacle smooth. Flowers 1½ to 2 lines high. In other respects like the preceding species.

In anthesis the styles and stigmas are much exserted, standing above the heads like projecting threads. The sheaths are obliquely fissured, obtuse at the point, veined like the leaves.

In still, shallow water, ponds and streams, New Jersey to Texas. Cuba. May to October.

3. ERIOCAULON DECANGULARE, L.

E. decangulare, L. Sp. Pl. 87 (1753).

Caudex short and thick, from one to two inches long. Leaves finely many-nerved, or often apparently nerveless, ensiform, tapering to a blunt point, usually much longer than the sheaths, 6 to 20 inches long and 2 to 8 lines broad. Scapes

stout, rigid, smooth, ten to fourteen-angled, I to 3 feet high. Heads 4 to 8 lines in diameter. Involucral scales ovate, often eroded, dentate at the apex and hairy below. Receptacle hairy, the hairs under the microscope many-celled, appearing acute at the apex or very rarely club-shaped. Flowers about 2 lines high, densely woolly at the base, the bract larger than the flowers acute, white-bearded. Perianth segments spatulate, white-bearded.

Swamps, New Jersey and Pennsylvania to Florida and Texas. Cuba. June to October.

4. ERIOCAULON RAVENELII, Chapm.

E. Ravenelii, Chapm. Fl. 503 (1860).

Very smooth throughout. Leaves linear, very acute, flat, thick or thin and pellucid, finely five to ten-nerved, somewhat longer than the sheaths. Scapes slender, 4 to 5 inches high, clustered, five to six-sulcate. Sheaths obliquely fissured, acute, Heads I to 2 lines in diameter. nerved like the leaves. Involucral scales scarious, light straw-colored, oblong, very obtuse. Bracts a little narrower than the scales, often obtusely pointed and denticulate, fuliginous. Flowers scarcely more than ½ line high, fuscous, smooth. Segments of the outer fertile perianth separate, very slender, mucronately pointed; of the inner somewhat broader, minutely toothed. Ovary sessile; style parted into two stigmas. Chapman states that the style is occasionally simple and the seeds minutely pubescent. The specimens which I have examined failed to show either.

Wet grounds, S. C.

5. ERIOCAULON TEXENSE, Körn.

E. Texense, Körn. Linnæa, xxvii. 595 (1854).

Scapes smooth, 8 to 10 inches high, six to seven-sulcate, slender, in the specimens examined solitary. Leaves acuminate, manynerved, fenestrate, flat, smooth, 1 to 2 inches long, a little shorter than the sheaths. Roots fibrous, the larger ones nodose. Heads hemispherical, 1 to 2 lines in diameter. Involucral scales obovate or nearly orbicular, smooth, entire, straw-colored. Receptacle pilose with silky hairs. Bracts as long as the flowers, cuneate or obovate, the upper part livid, the lower whitish,

rounded or more commonly pointed at the apex, hairy on the back and fimbriate at the apex with a coarse white beard. Flowers about I line long. Outer perianth segments in the staminate flower free, abruptly acute, slightly longer and larger than the inner, spatulate, fuscous above and bearded. Pistillate flowers bearded similarly to the staminate, the lobes occasionally three; ovary shortly stipitate, dicoccous; stigmas two. The heads appear densely villous. This species is easily distinguished from E. articulatum and E. compressum by its villose receptacle, and from E. decangulare by its smaller stature, its more slender scape, shorter and acute bracts, smaller heads and flowers.

Texas, Drummond, 2nd coll., n. 409.

 ERIOCAULON KÖRNICKIANUM, Van Heurck & Müll. Arg.
 E. Körnickianum, Van Heurck et Müll. Arg. Obs. Pl. Nov. Herb. Van Heurck, 101 (1870).

I have not seen a specimen of this Texan plant, but the authors of the species describe it as having pellucid leaves which are five to seven-nerved, plane, smooth, 8 to 11 lines long and a little over I line wide at the base. Scapes numerous, 4 to 5 inches high, setaceous, smooth, compressed, two to three-angled, with lax sheaths which are as long as the leaves. Heads ovoidglobose, about I 1/2 inch long, a little longer than broad. cral scales fuliginous, broadly obovate, irregularly denticulate and white-woolly above, at length slightly recurved. smooth. Bracts not quite I line high, surpassing the flowers. Sterile flowers about ½ line high; outer perianth segments smooth and black-glandular at the apex; inner obovate and pilose at the apex. Stamens four. Inner perianth segments of the fertile flower white-woolly on the margins. Style two-parted, plainly destitute of appendages. Seeds ellipsoidal, rough papillose.

East Texas. Coll. Charles Wright, in Herb. DC. et Van Heurck.

7. ERIOCAULON MICROCEPHALUM, H. B. K.

E. microcephalum, H. B. K. Nov. Gen. i. 253 (1815); Kunth Enum. 3, 548 (1841).

Small cæspitose plants. Leaves 4 to 8 lines long, acute, five to eight fenestrate-nerved, smooth above, often woolly at

Scapes clustered, numerous, 4 to 6 lines high, the base. smooth, four-angled, the angles often separated by finer intermediate striæ. Sheaths shorter than the leaves, rather obtuse at Heads globular, about I line in diameter. the point. cral scales broadly obovate, entire or denticulate, very light straw-colored, smooth or sometimes scantily fimbriate at the Bracts obovate, acute or obtuse, Receptacle smooth. longer than the flowers, bearded at the apex. Flowers trimerous. a little more than I line high. Staminate flowers pedicellate; exterior perianth segments sometimes two only, obtuse, the posterior ones connate in a keeled hood and white pilose at the top; interior segments white, tubular below, three-lobed above, the lobes fimbriate, rounded, denticulate or entire at the apex. Stamens six. Fertile flowers sessile, exterior perianth segments often two only; fuscous above and pilose, the interior more delicate and longer, white, spatulate, obtuse, pilose internally and on Ovary sessile, three-celled. Style three-parted; the margin. stigmas three.

This species has found its way from Jalisco, Mexico, where it is common, to Fort Tejon, California, at which place it was collected by Xantus in the expedition of 1857–8, although it is not enumerated in Dr. Gray's list of Xantus' plants. I find specimens of it without a name in the Torrey Herbarium.

8. ERIOCAULON BENTHAMI, Kunth.

E. Benthami, Kunth. Enum. 3, 545 (1841), originally published by Bentham in his Pl. Hart., p. 28, as "Eriocauli, sp. nov?"

Leaves I to 3 inches long, smooth, about the same length as the sheaths or longer; eight to twelve-nerved, obtuse and callous at the apex. Scapes 4 to 15 inches high, smooth, six or seven-sulcate. Roots thick, nodose. Heads very white-woolly, globose, 2 to 3 lines in diameter. Involucral scales smooth, obtuse, somewhat longer than the bracts, straw-colored. Receptacle pilose. Bracts spatulate, fuscous, abruptly acute, woolly on the back and coarsely white-bearded on the apical margins. Flowers I ½ line high; perianth six-parted, the three exterior segments free, white below, fuscous above and bearded at the apex. In the staminate flower the interior perianth is stipitate

and the two anterior segments are connected with the posterior one; in the pistillate flower they are free. All the segments are bearded at the apex. Stamens six. Ovary stipitate, three-celled; style three-parted. The species is well distinguished from *E. decangulare*, to which it is similar in habit, by its six-parted flowers. Hartweg collected this plant at Lagos, Mexico.

Wet grounds, Province of Jalisco, Mexico, Palmer, 1886, No. 44, and Pringle, 1888, No. 1,734. June–November.

9. ERIOCAULON PRINGLEI, S. Wats.

E. Pringlei, S. Watson, Proc. Am. Ac. xxiii. 283 (1888).

A delicate plant with slender five to six-sulcate scapes ½ to 5 inches high, all the parts very smooth. Leaves acuminate, flat, about three-nerved, as long as or a little longer than the sheaths. Roots finely fibrous, spongy. Heads I to I½ lines in diameter, fuscous. Involucral scales obovate, scarious, very dark, eroded at the apex. Receptacle smooth. Bracts pointed. Flowers scarcely ½ line high. Exterior perianth segments in both kinds of flowers two; the interior three. Sterile flower—outer segments free, pointed, entire; inner with a short tube or stipitate, eroded or denticulate at the apex. Stamens six. Fertile flower—outer segments the same; inner very narrow, shortly tubular at base. Ovary three or sometimes two-celled. Style three or sometimes two-parted.

Wet places at the base of Sierra Madre, Chihuahua, Mexico. Pringle, No. 2,018. October.

2. DUPATYA, Vell. Fl. Flum. 35, No. 42 (1825).

Pæpalanthus, Mart. Nov. Act. Nat. Cur. xvii. 1, 13 (1833-5). This genus closely resembles Eriocaulon in general appearance and habit, but is distinguished by having the interior segments of the sterile flower campanulate-tubular, and the stamens of the same number as the lobes. The flowers are with rare exceptions three-parted throughout, the three stigmas often bifid. Seeds oval, more or less costate.

The genus is very extensively represented in South America, being concentrated in Brazil. Körnicke in his monograph enumerates 215 species. Only one is found in North America.

I. DUPATYA FLAVIDULA (Mx.).

Eriocaulon flavidulum, Mx. Fl. ii. 166 (1803).

Pæpalanthus flavidulus, Kunth, Enum. iii. 532 (1841). Dupatya flavidula, Kuntze, Rev. Gen. Pl. 745 (1891).

Leaves 1 to 2 inches long, three to five-nerved, linear-subulate, floccose at base and smooth or sparingly pubescent above. Scapes numerous, five-sulcate, pubescent, 4 to 12 inches high. Sheaths longer than the leaves, obliquely fissured, slightly inflated at the summit, pubescent like the scape. Heads 2 to 3 lines in diameter. Involucral scales straw colored, scarious, smooth, shining, oval or ovate, obtuse, somewhat hairy at base. Receptacle Bracts very thin, white, linear, rounded or pointed at the apex, about as long as the flowers, slightly hairy, often obsolete. Flowers about 1 1/4 line high, trimerous, long pedicellate. Sterile flowers—outer perianth segments woolly at base, obovate or truncate and pilose at the apex. This encloses the inner part of the perianth consisting of a smooth, delicate, white; campanulate, somewhat three-toothed tube; stamens three, slightly exserted. Fertile flowers—outer perianth segments distinct, hairy at base, linear, acute, smooth, white, upper similar but much narrower, enclosing the ovary and connate over it nearly to the top. Style three-parted, forming three stigmas. Seeds sparingly and obscurely costate when mature. Roots spongy, scarcely nodose.

Körnicke (Linnæa, 27, 590) under the name Eriocaulon flavidulum, Mx., following Pursh (Fl. 1, 92) and Elliott (Bot. ii 566) states that two plants have been sent from North America under this name and that he regards Kunth's P. flavidulus as something distinct from the plant of Michaux. That which he describes is undoubtedly something distinct and is clearly an Eriocaulon, but, so far as I can judge, it corresponds very nearly, if not quite, to E. articulatum. The plant of Elliott is also, I think, that species. Michaux distinctly calls his species puberulent and the scapes aggregated and five-striate, while his other characters correspond very well with our plant. There is not, so far as ascertained, any other in the habitat given by him, "Carolina" that bears such characters.

Low sandy pine barrens, So. Va. to Florida. March-July.

3. LACHNOCAULON, Kunth, Enum. iii. 497 (1841).

Very similar to *Eriocaulon* in general appearance and habit, but distinguished by having the outer perianth only, the flowers always three-parted, three stamens which coalesce in a tube beneath, and one-celled anthers. The staminal tube appears to take the place of the sterile outer perianth segments of *Eriocaulon* and *Pæpalanthus*, and the place of the inner segment of the fertile flower is occupied in this genus by a loose mass of hairs, or sometimes by three rows of hairs. Style club-shaped, dividing into three bifid stigmas which alternate with three appendices.

The genus is confined to the Southern United States, in which four species occur.

I. LACHNOCAULON ANCEPS (Walt).

Eriocaulon anceps, Walt. Fl. Car. 83 (1788).

E. villosum, Mx. Fl. ii. 166, (1803) Pursh, Fl. i. 92, (1814).

L. Michauxii, Kunth, Enum. iii. 497, (1841) Chap. Fl. 504, (1860).

Leaves 1 to 3 inches long, tapering to an obtuse callous point, smooth or sparingly hairy, seven to twelve-nerved or often apparently nerveless. Scapes slender, 2 to 20 inches high, two to fourribbed, the ribs themselves often with intermediate striæ, clothed with long, soft, appessed, upwardly-pointed hairs. Sheaths as long as or shorter than the leaves, hairy like the scape, and pointed like the leaves. Heads globose, I to 3 inches in diame-Involucral scales ovate or oblong, obtuse or pointed, smooth or hairy, shorter than the flowers, usually fuliginous. Flowers about I line high, bracts fuliginous, spatulate, often keeled, surrounded at base by the yellowish, silky hairs of the villose receptacle and white bearded at the apex. Perianth segments in the sterile flower on a short stipe which is hairy at the base, spatulate, fuliginous and fimbriate at the apex. Those of the fertile flower white, smooth, oblong, obtuse; ovary sessile, densely villous around the base; style three-divided; stigmas bifid, seeds strongly costate. Roots finely fibrous. segments of the fertile perianth mingled with the fuliginous woolly segments of the sterile flowers impart a mixed gray and dark appearance to the heads.

Low pine barrens, So. Va. to Florida. March-June.

2. Lachnocaulon glabrum, Körn.

L. glabrum, Körn. Linnæa, xxvii. 568, (1854), Chap. Fl. 504, (1860).

Leaves ½ to ¾ inch long, flat, acuminate, blunt and callous at the tips, about as long as the sheaths, smooth or with a few. scattered hairs at the margins. Scapes numerous, smooth, 3 to 4 inches high, and three to five-angled. Heads very dark and nearly smooth externally, at first globose, becoming cylindrical or slightly conical and 3 lines long, looking, as Chapman observes, not unlike those of Eleocharis ovata. Involucral scales fuscous, lighter in color than the bracts and flowers, ovate, acute, smooth or pubescent. Receptacle villous with clavate hairs. Bracts very dark, pubescent, carinate on the back and cucullate at the apex, enclosing the flowers. Flowers scarcely ½ inch high, much smaller than those of No. 1. Segments woolly at base, the anterior much like the bract and partially enclosing the others. The peculiar dark, matted, and smoothish appearance of the heads in this species is owing to the cucullate bracts and flowers which are closely packed together.

Roots finely fibrous, not nodose. Ovary three-celled, styles divided into three stigmas. Körnicke makes the stigmas bifid, but in all the specimens that I have examined they are entire. Seeds strongly costate.

Sandy shores of the Gulf of Mexico, Florida. (Chapman). Oct.

- 3. LACHNOCAULON BEYRICHIANUM, Sperdeler.
- L. Beyrichianum, Sperdeler in Körn. Linnæa, xxvii. 567, (1854).

Leaves bright green, I to I½ inch long, tapering to a sharp point, obscurely nerved, often woolly at base, scantily hairy above, somewhat longer than the sheaths. Scapes numerous, I to 3 inches high, three to five-striate, sparsely hairy, the hairs like those of No. I. Heads globose or cylindrical and slightly longer than broad, I to I½ lines long, grayish-villose, the hairs very apparent. Involucral scales oblong, obtuse, hairy or becoming glabrate, fuscous. Bracts spatulate, somewhat larger than the flowers, smooth or grayish pubescent above. Segments of perianth much the same. Flowers scarcely half a

line high. Receptacle hairy as in No. 2. Styles divided into three simple stigmas.

Körnicke attributes this species to Ebenezer, a place in middle Georgia, collected there in July by Beyrich. It was distributed as *L. glabrum* by Curtiss, No. 3,022, collected by him on "Sandy shores, Walton County, N. W. Florida." September.

Bentham and Hooker (Gen. Pl. iii. part 2, p. 1,024) regard Körnicke's plants as well developed specimens of *L. anceps*, but the species is quite distinct both from *L. anceps* and *L. glabrum*. From the former it is distinguished by its much smaller size, numerous scapes, smaller and more elongated heads, obtuse involucral scales, far smaller flowers and simple stigmas; from the latter by its hairy scapes, grayish-villose, nearly globose and far smaller heads.

4. LACHNOCAULON DIGYNUM, Körn.

L. digynum, Körn. Linnæa, xxvii. 570, (1854).

I have not seen specimens of this. Körnicke attributes it to Alabama, from whence it was sent by Bentham, and describes it as having a leafy epigean stem ½ to 1½ inch in length. Leaves smooth, nervose-striate, flat, bright green, 4 to 7 lines Scapes smooth, 3 to 5 inches high. Sheaths obliquely fissured, sparsely pilose, a little longer than the leaves. semi-globose, I line in diameter, grayish-villose. Involucral scales oblong, acute, ciliate at the apex and villous on the back, at length glabrescent, fuscous. Bracts spatulate, carinate. ceptacle pilose. Flowers pedicellate; segments of the perianth connate toward the base, spatulate, rounded and hairy at the apex. Stamens three, anthers oblong, white; the triple segments of the rudimentary pistil in the sterile flower papillose. Fertile flowers sessile, segments of the perianth free, obovate, narrowed at the base, pilose at the top of the back. It differs, according to Körnicke, from all the preceding species in having a two-celled ovary, two appendices, a two-parted style and bifid stigmas.

It is regarded by Benth. and Hook. l. c. as probably a depauperate form of *L. anceps*, with heads not yet well developed, but it appears to me to come much nearer to *L. Beyrichianum*. Fresh specimens are very desirable.